

Riding silicon trends into our future

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Circa 1975



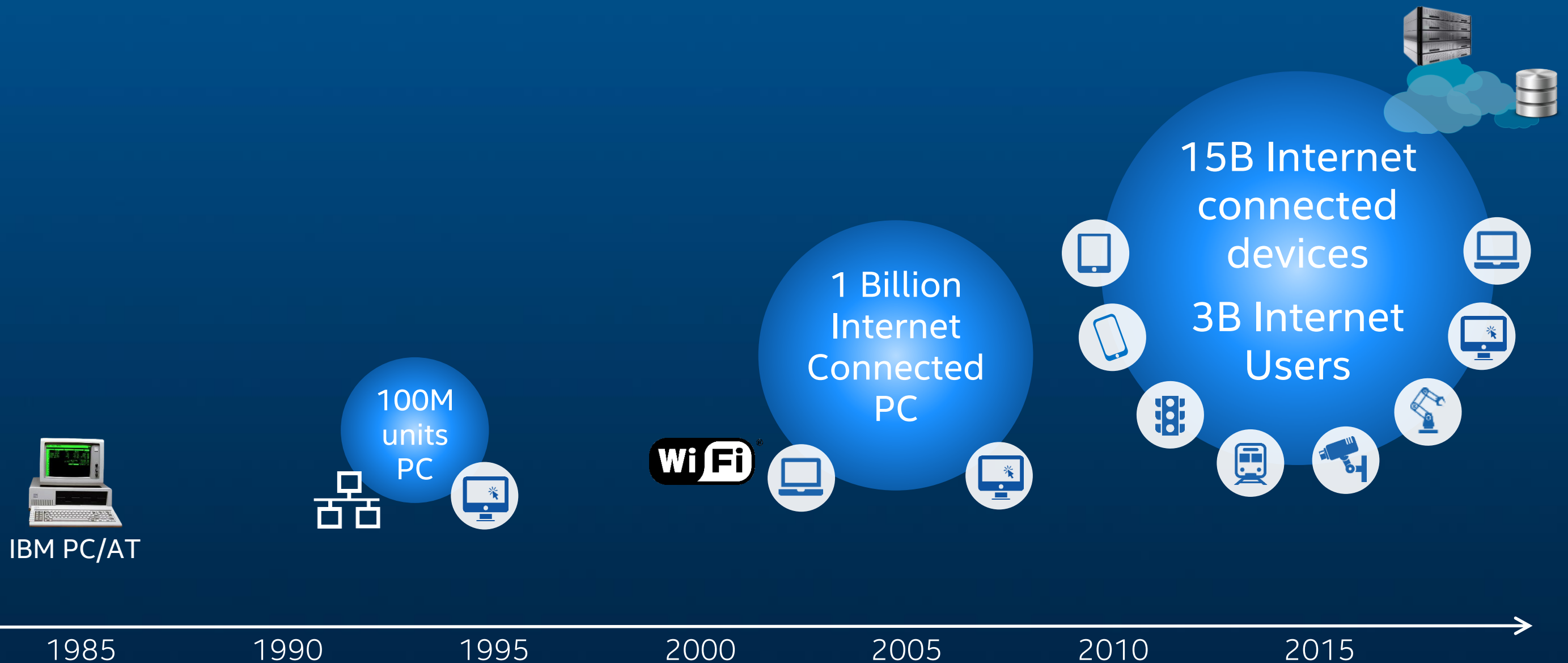




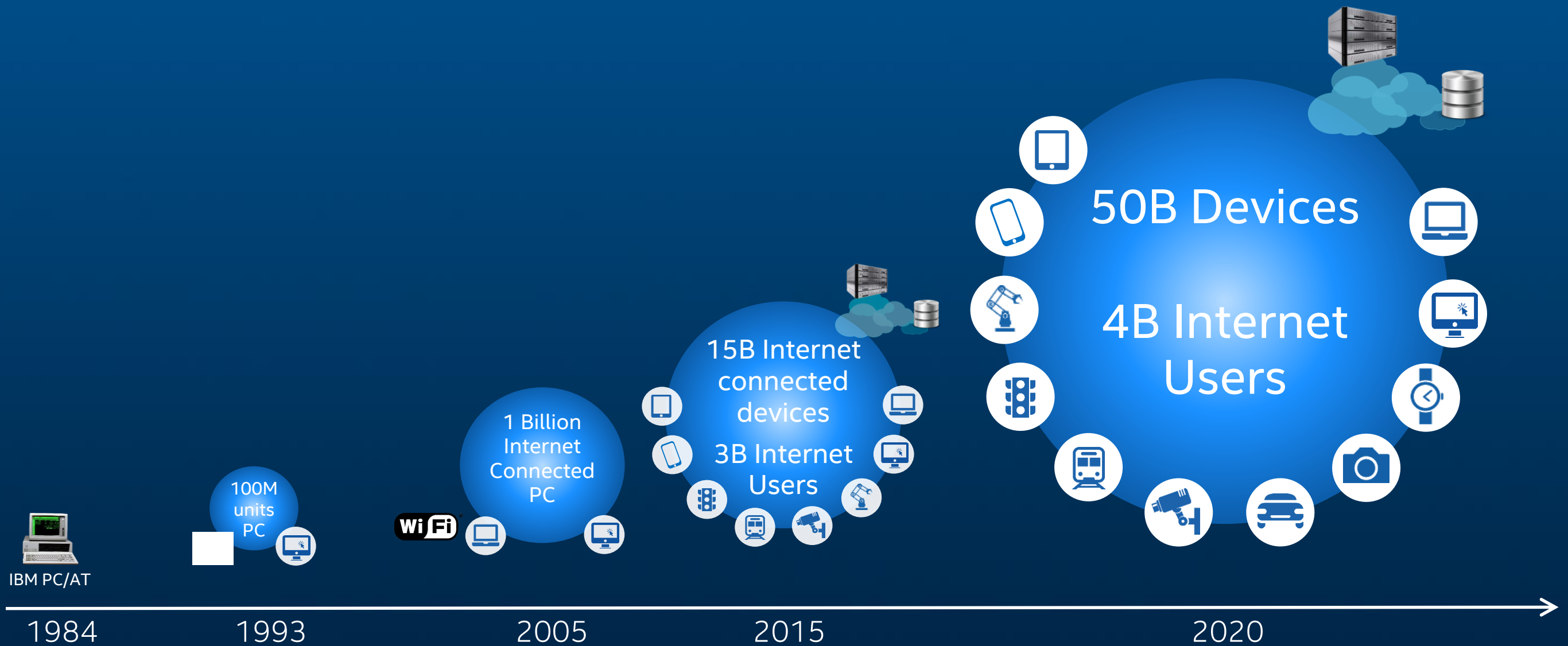


Circa 1985

Digital Revolution unfolds

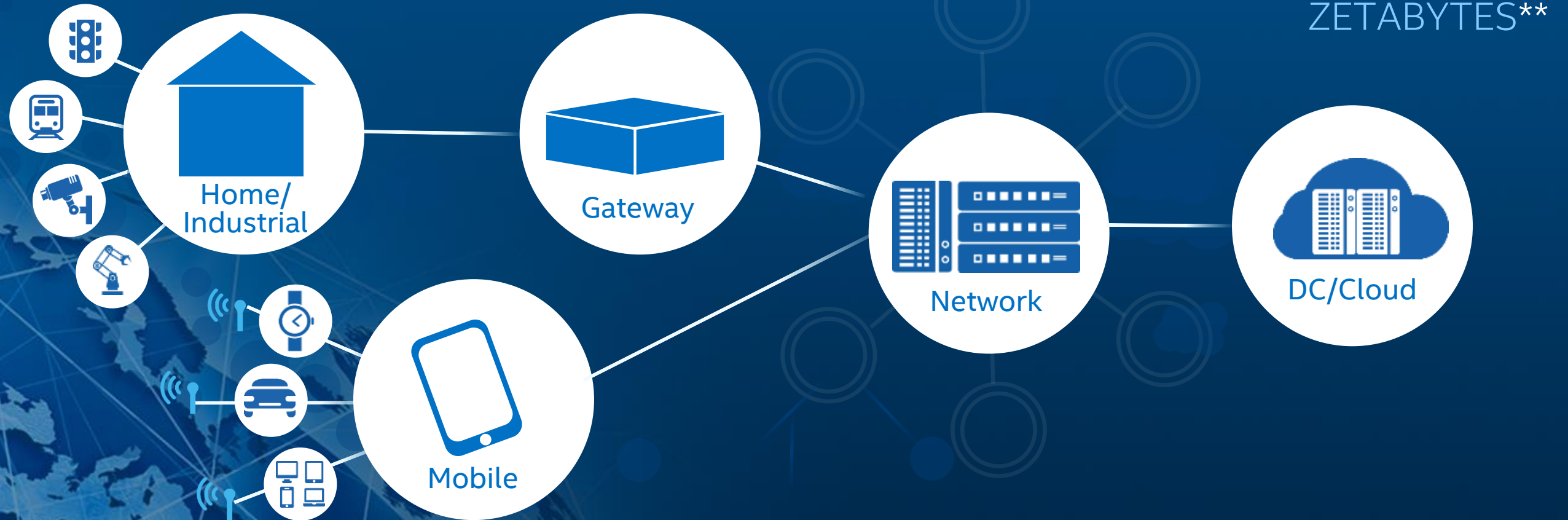


It has just begun



IOT - Fueling the revolution

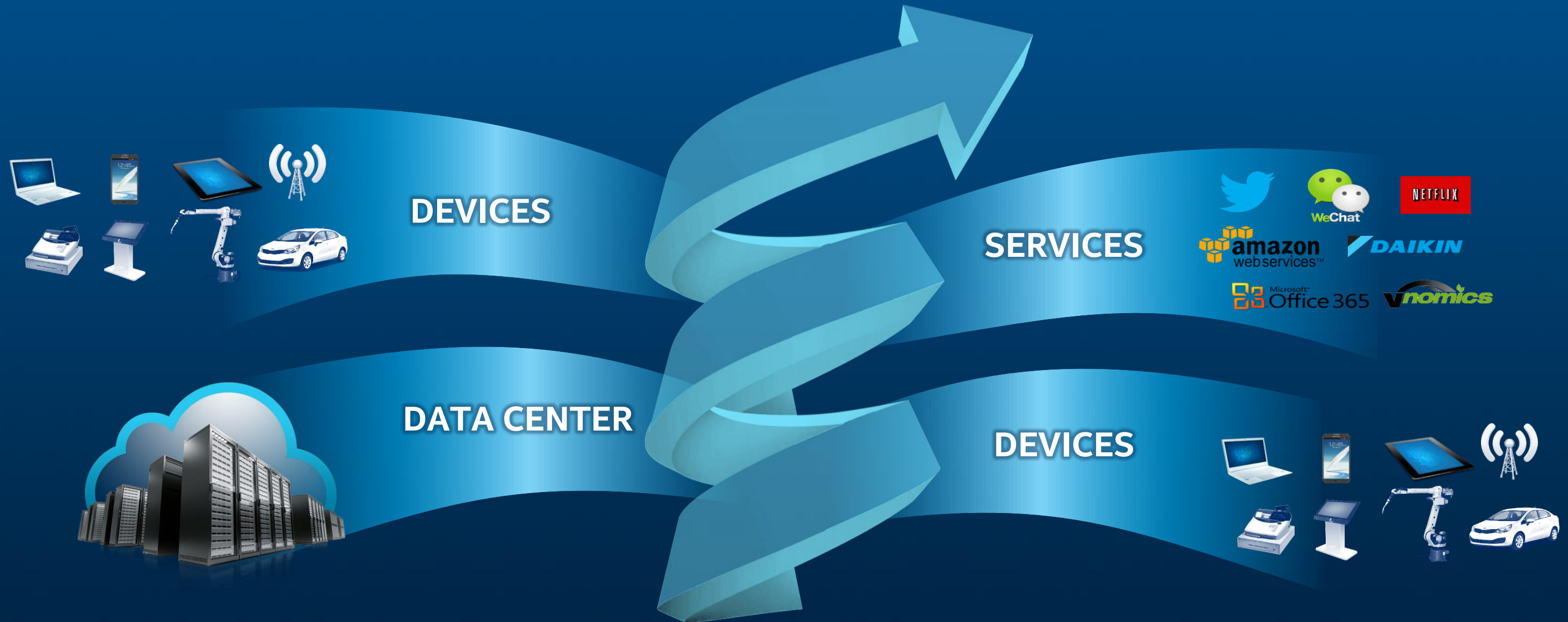
50B
DEVICES *



44
ZETABYTES**

Built-in, secure, interconnected intelligence

The upward spiral



PC – Experience innovation continues

DESKTOPS



NOTEBOOK & 2 in 1s



NO WIRES

Wireless Display
Wireless Data
Wireless Charging
Wireless Docking

NO PASSWORDS

YAP –
You are the
Password

NATURAL USER INTERFACE

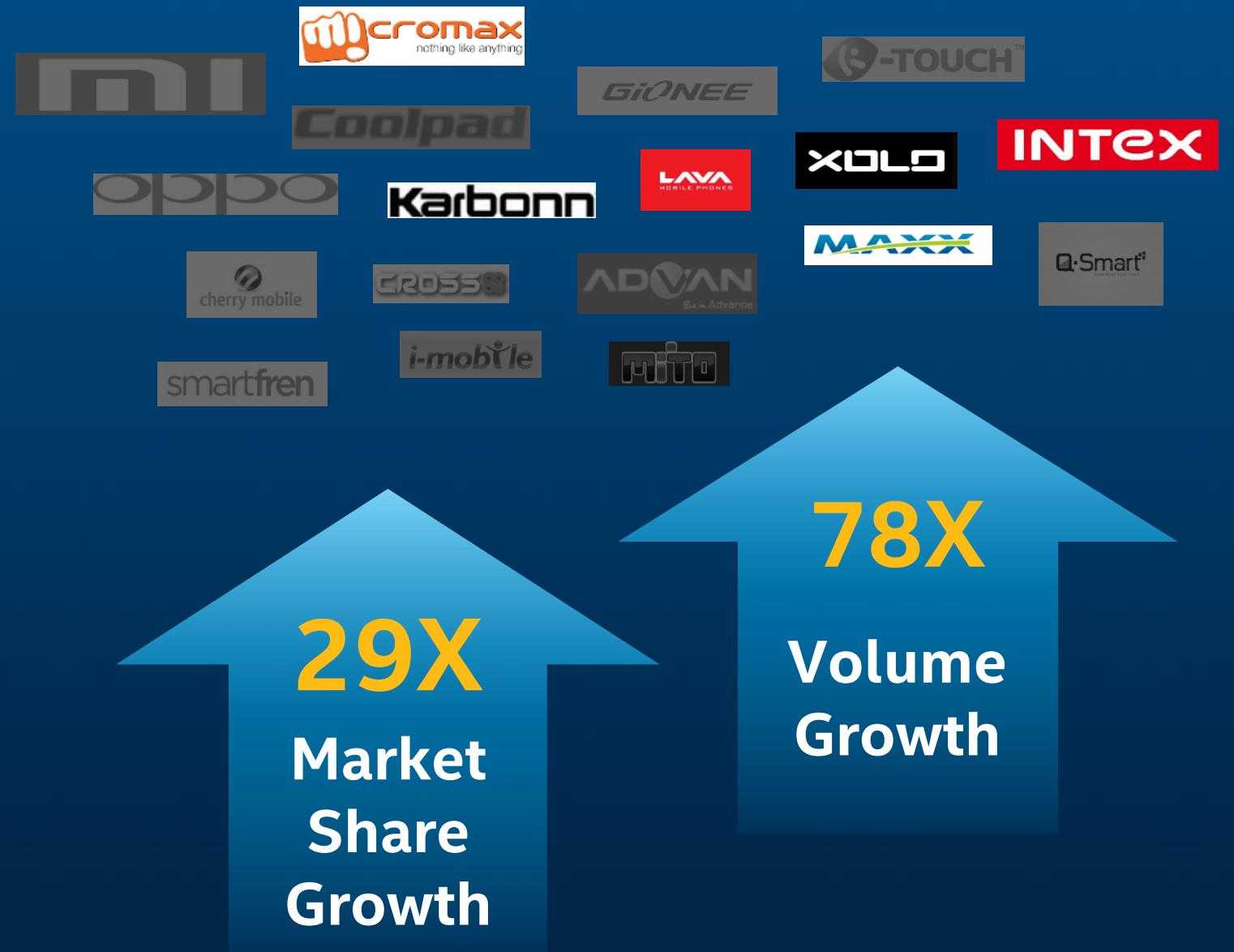
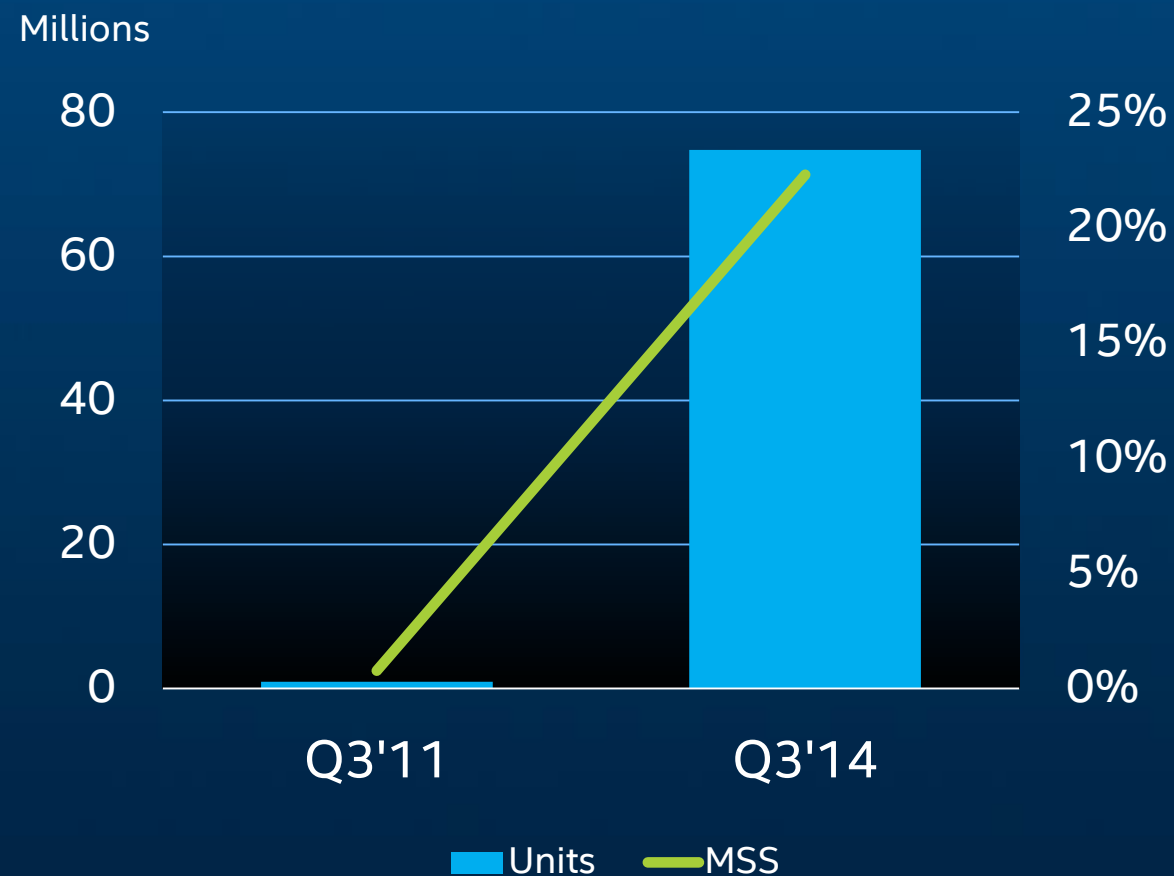
Front Facing 3D
Rear Facing 3D
Voice Assistant

ACROSS ALL O/S



Smart phones – Globalization of innovation

Local Brands Smartphone Growth in 3 years





So what do these market trends mean?



If it is not smart,
it is time for it to be smart

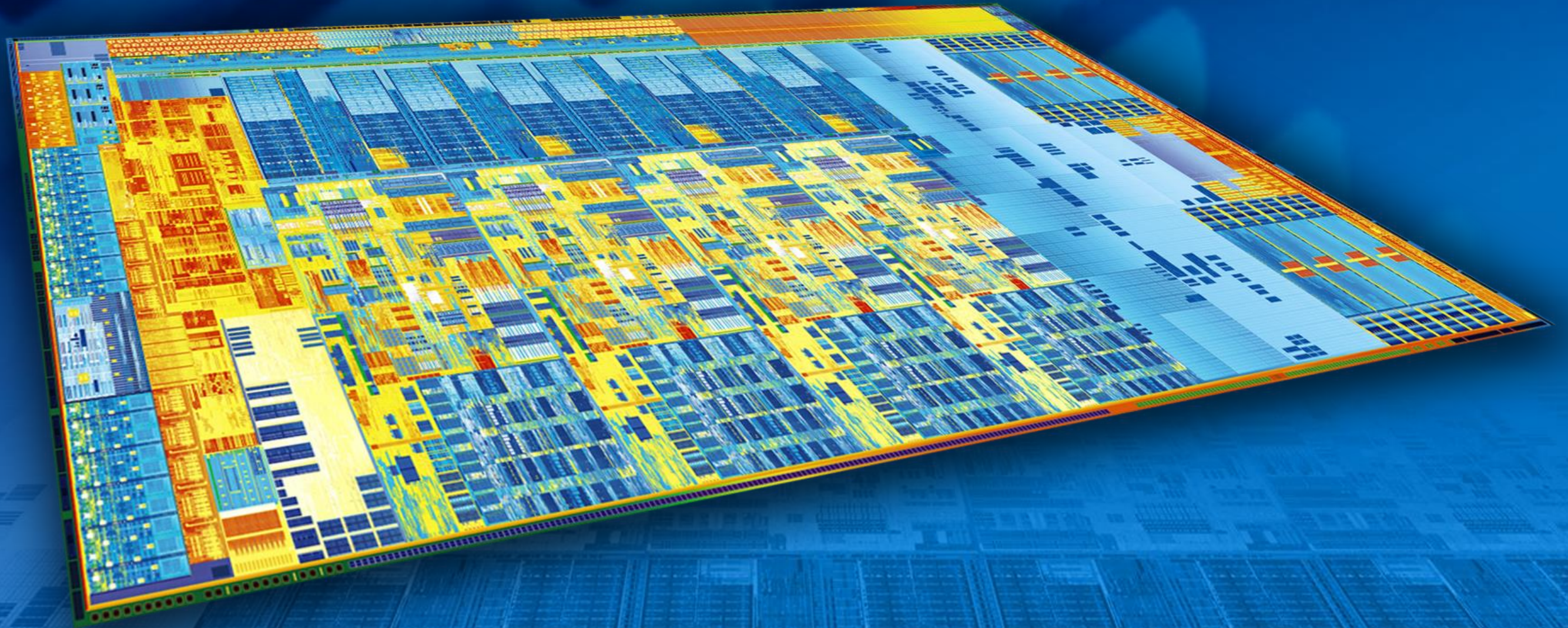
If it is smart,
it computes and it connects



If it computes and connects,
it does it on silicon

Semiconductors

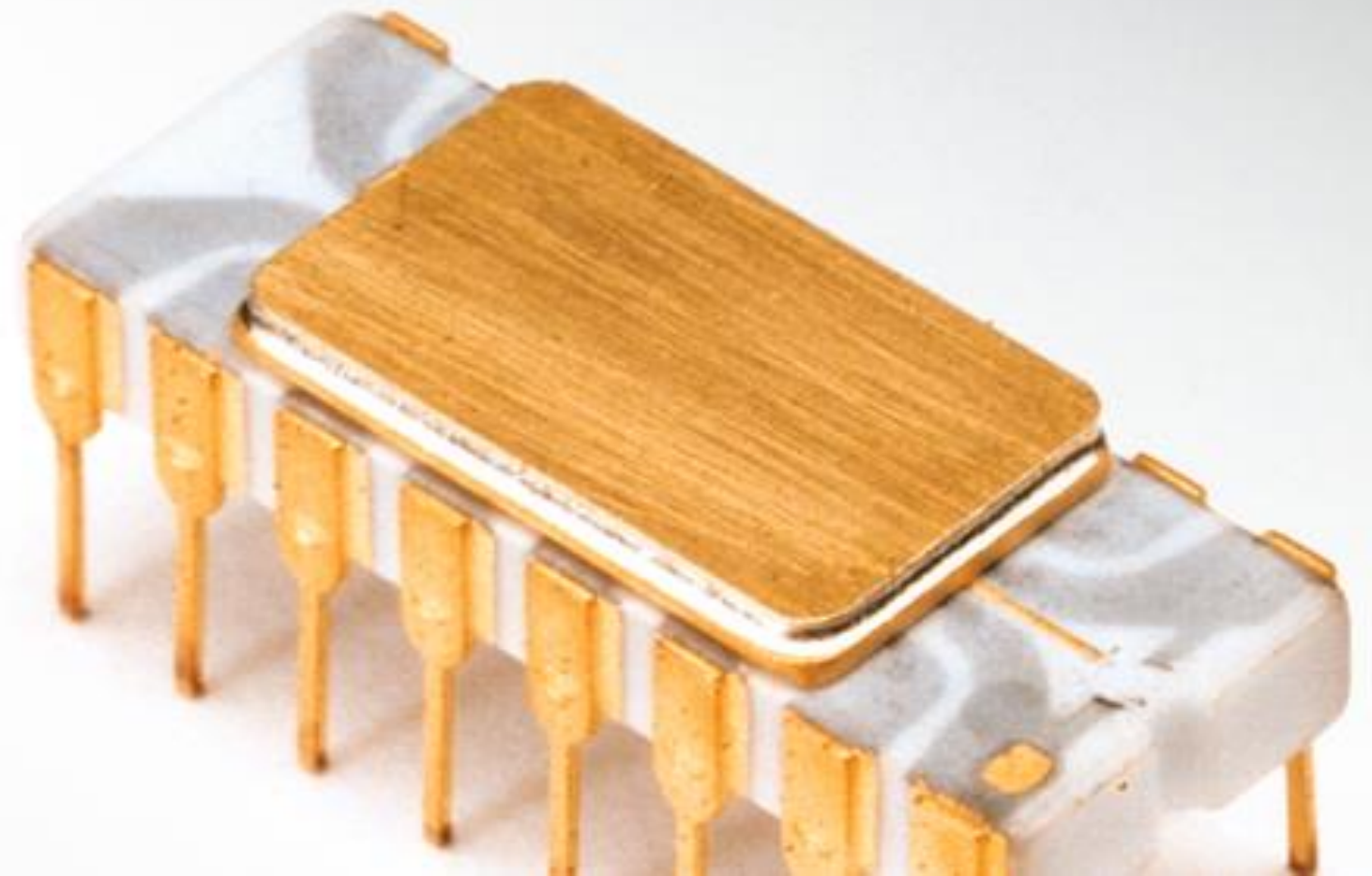
The foundational core of the digital revolution



A lasting semiconductor trend

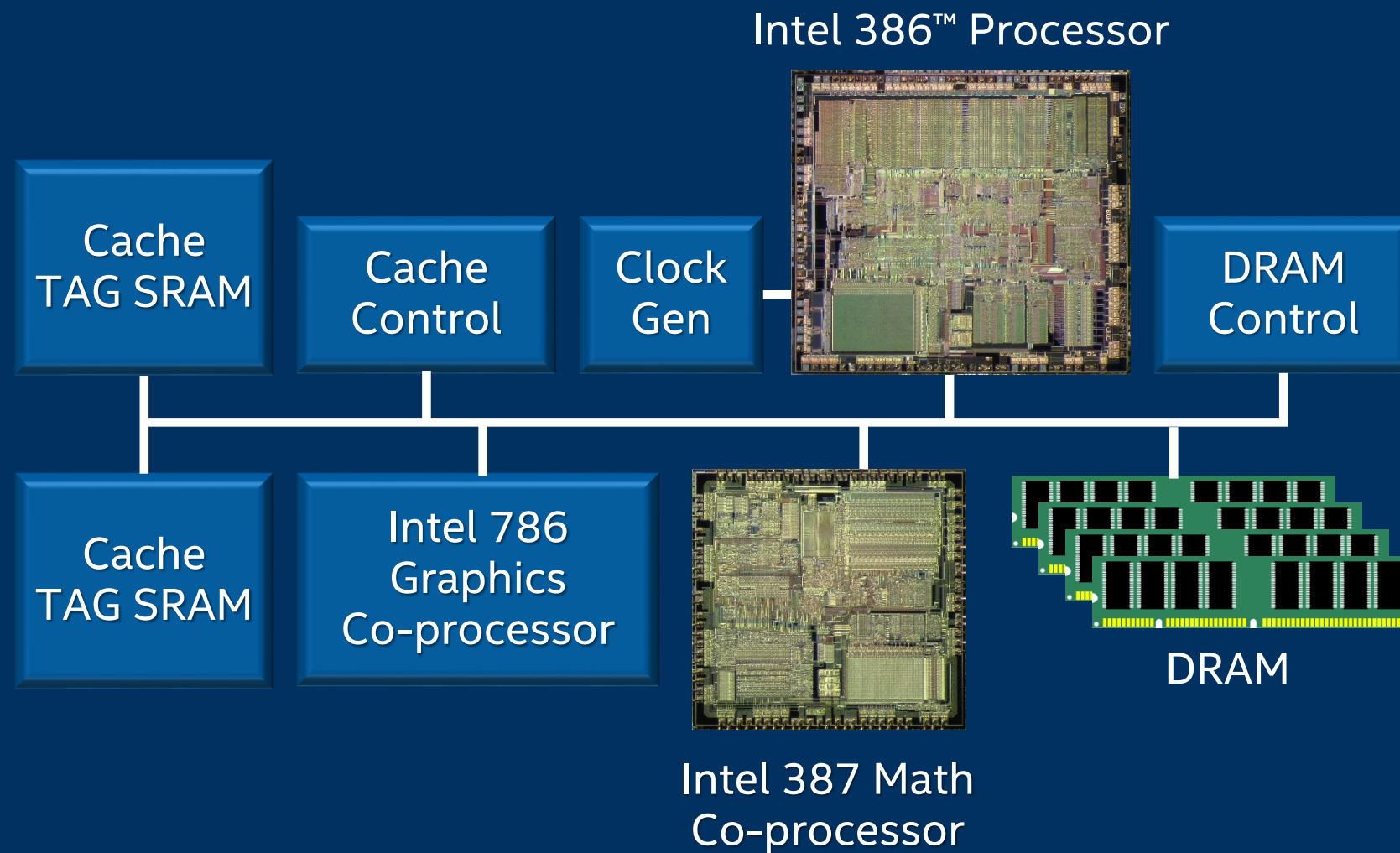


Integration – a lasting trend



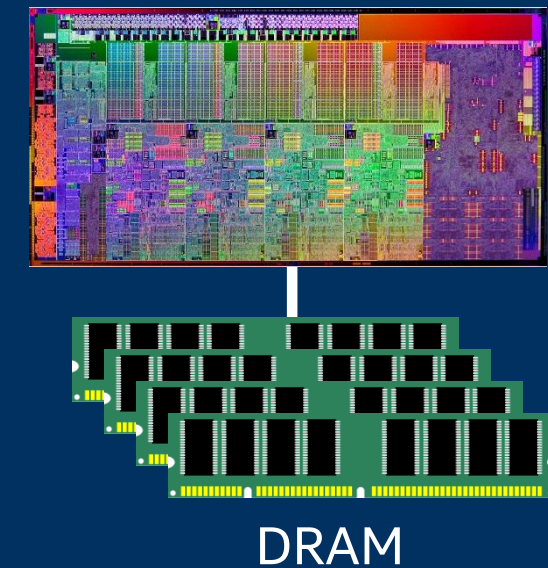
Integration – a lasting trend

1985

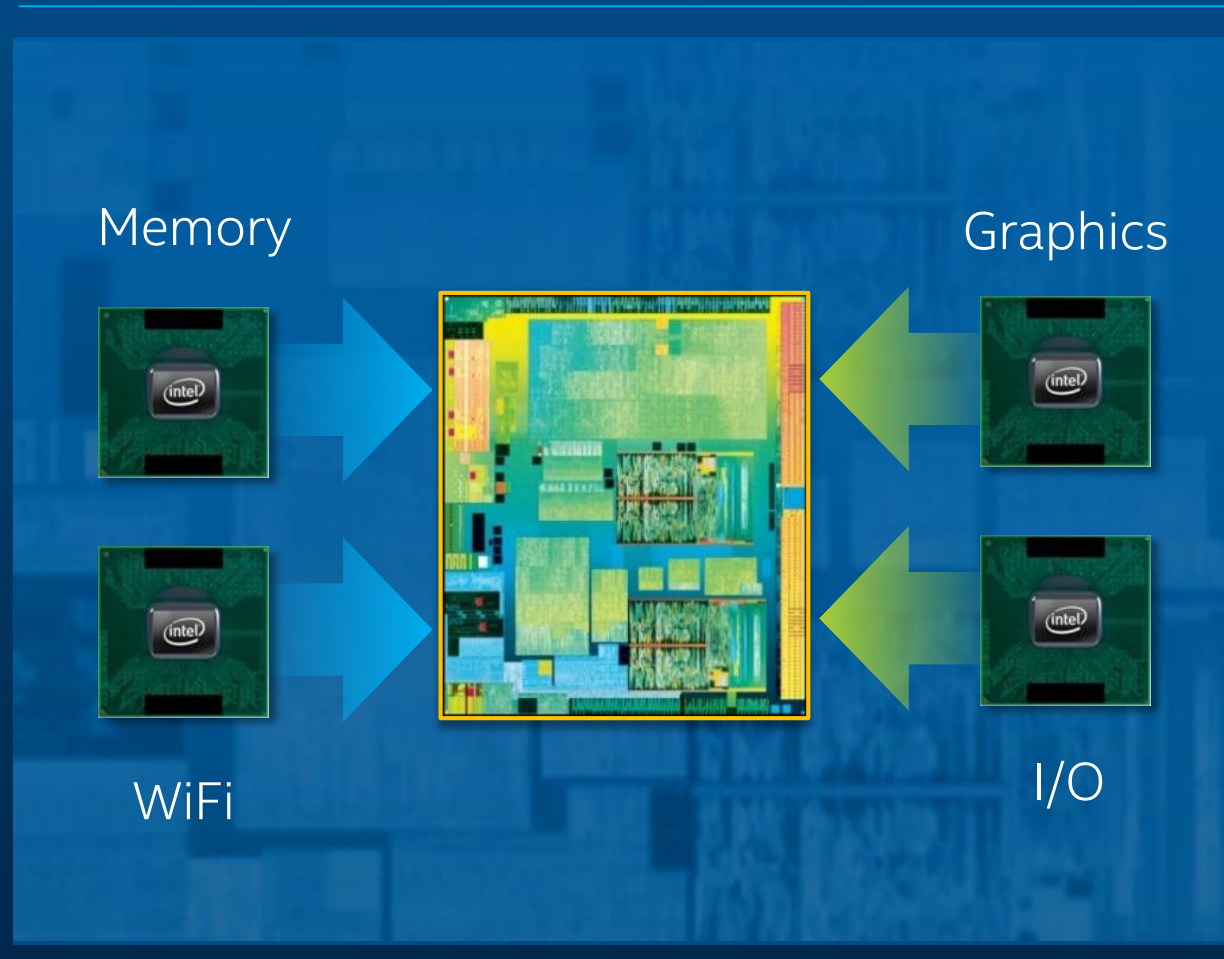


2011

Sandy Bridge Processor



Integration – a lasting trend



Processor

CPU
GPU

Memory

SRAM
DRAM
NAND Flash
NOR Flash

IO/Analog

USB
Audio Codec
Video Enc
Video Dec
Imaging
Display
Power Mgt

Sensor

3-Axis
Accelerometer
3-Axis
Gyroscope
Compass

Wireless

Wi-Fi
GSM
Edge
3G
4G/LTE
Blue Tooth
GPS
FM

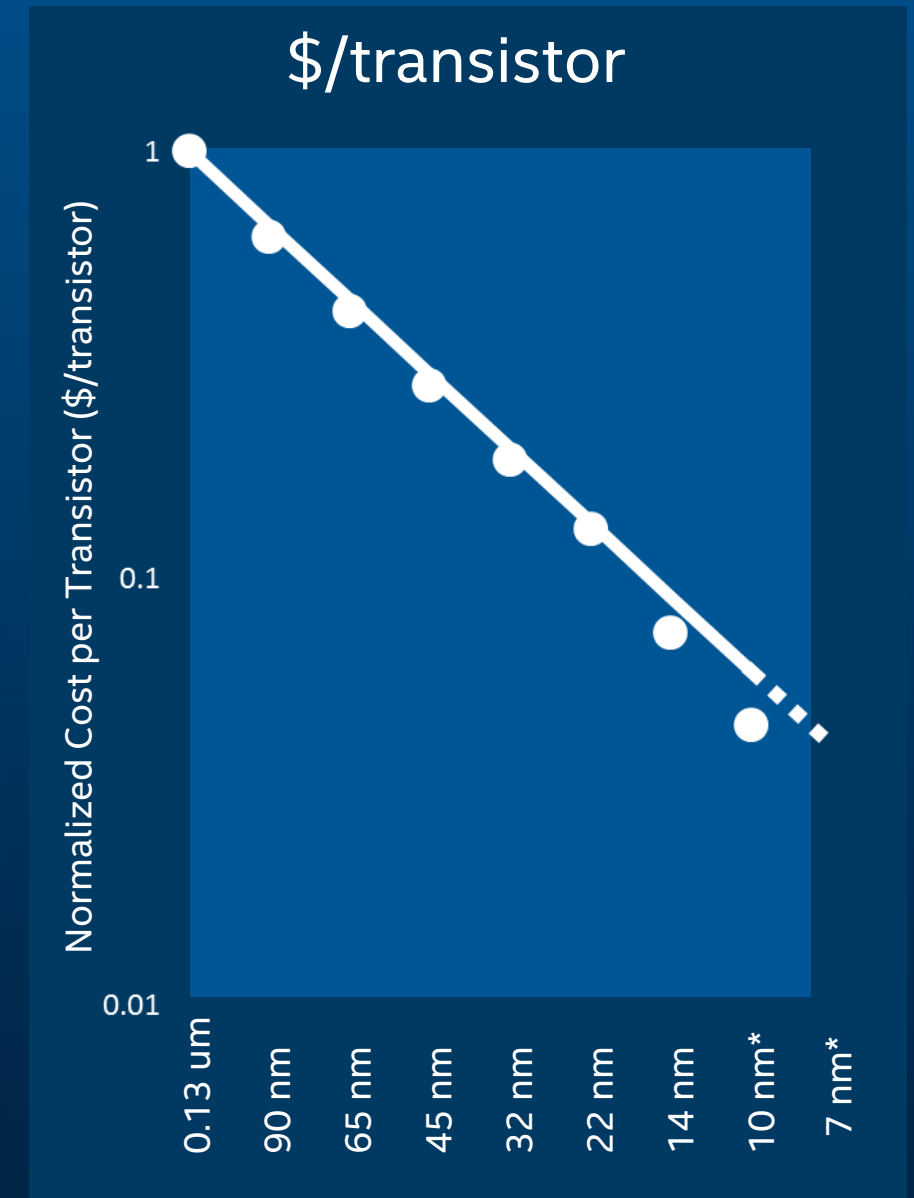
Baseband
Transceiver
Power Amp
Front End



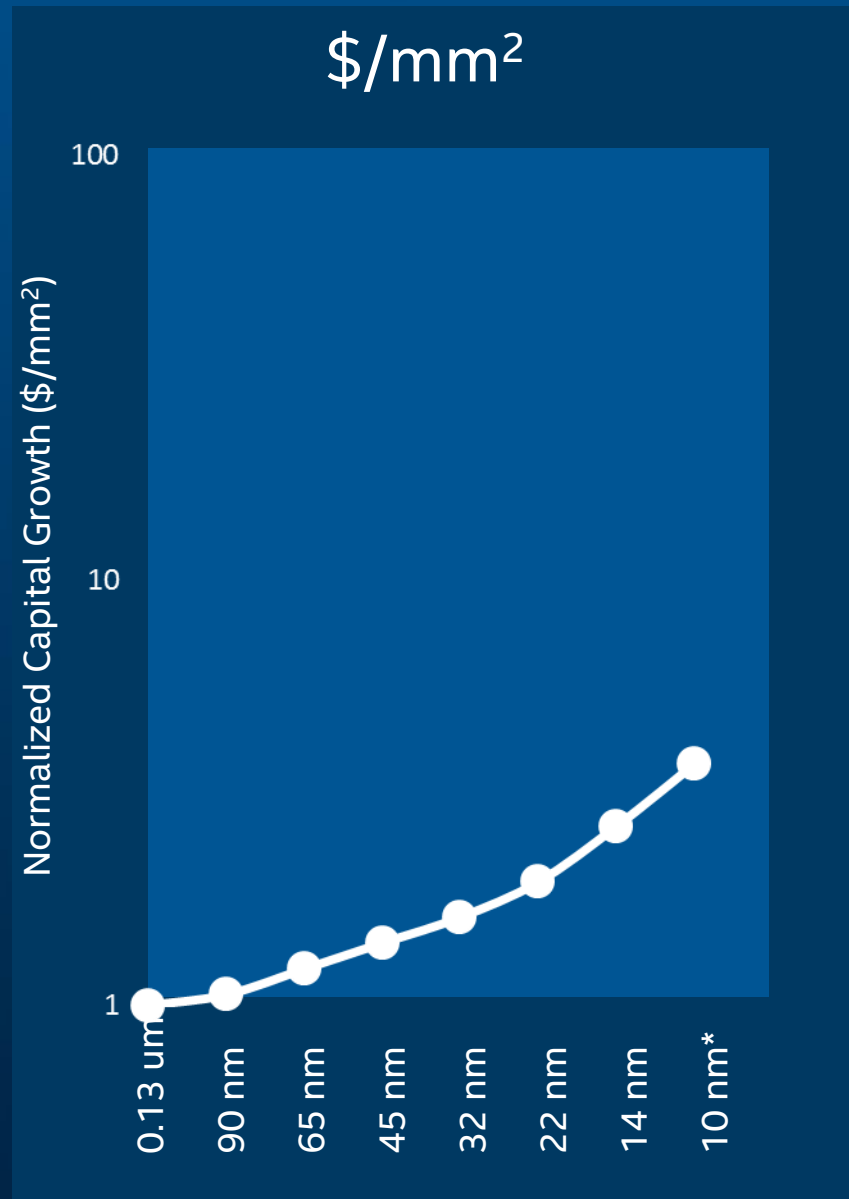
What is the enabler of this
lasting trend?

Moore's Law economics

Exponential decrease in
cost per transistor

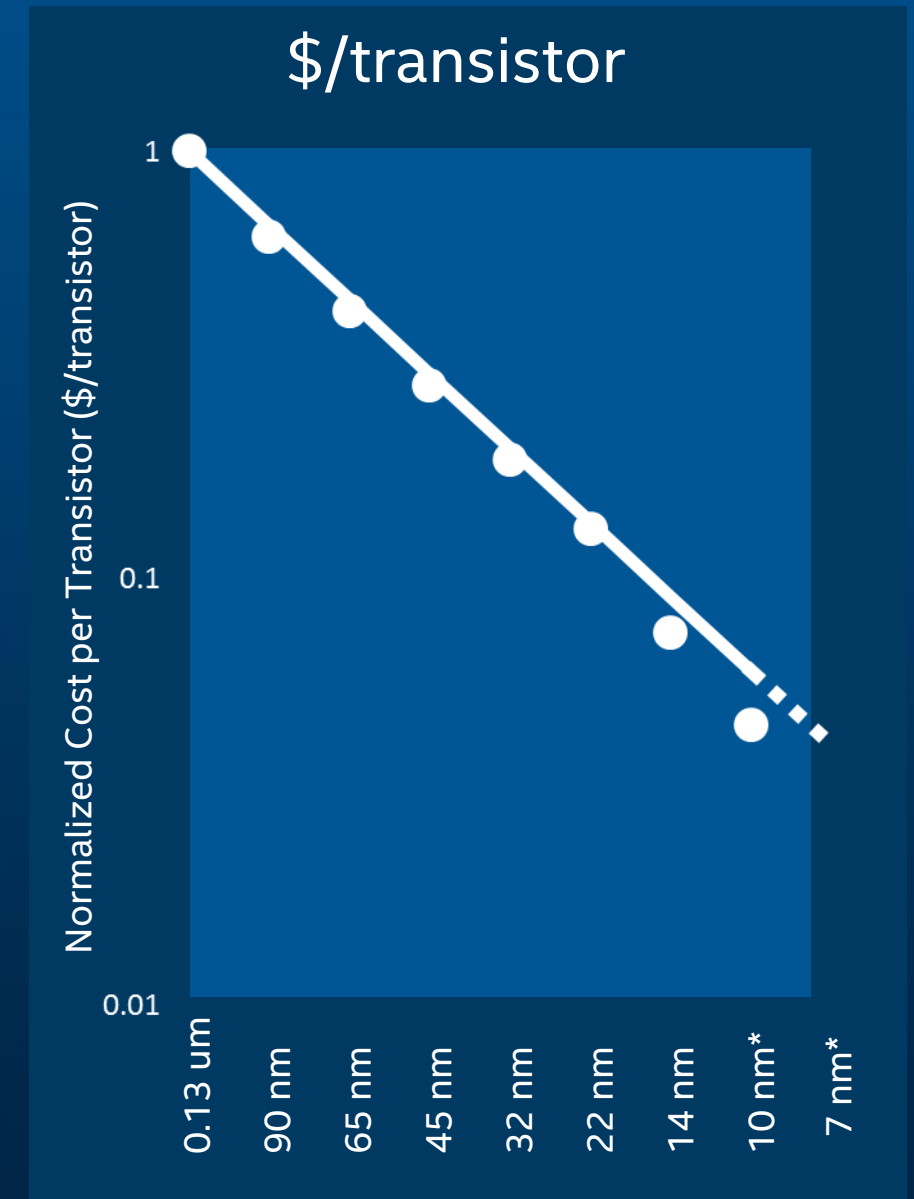


Moore's Law economics

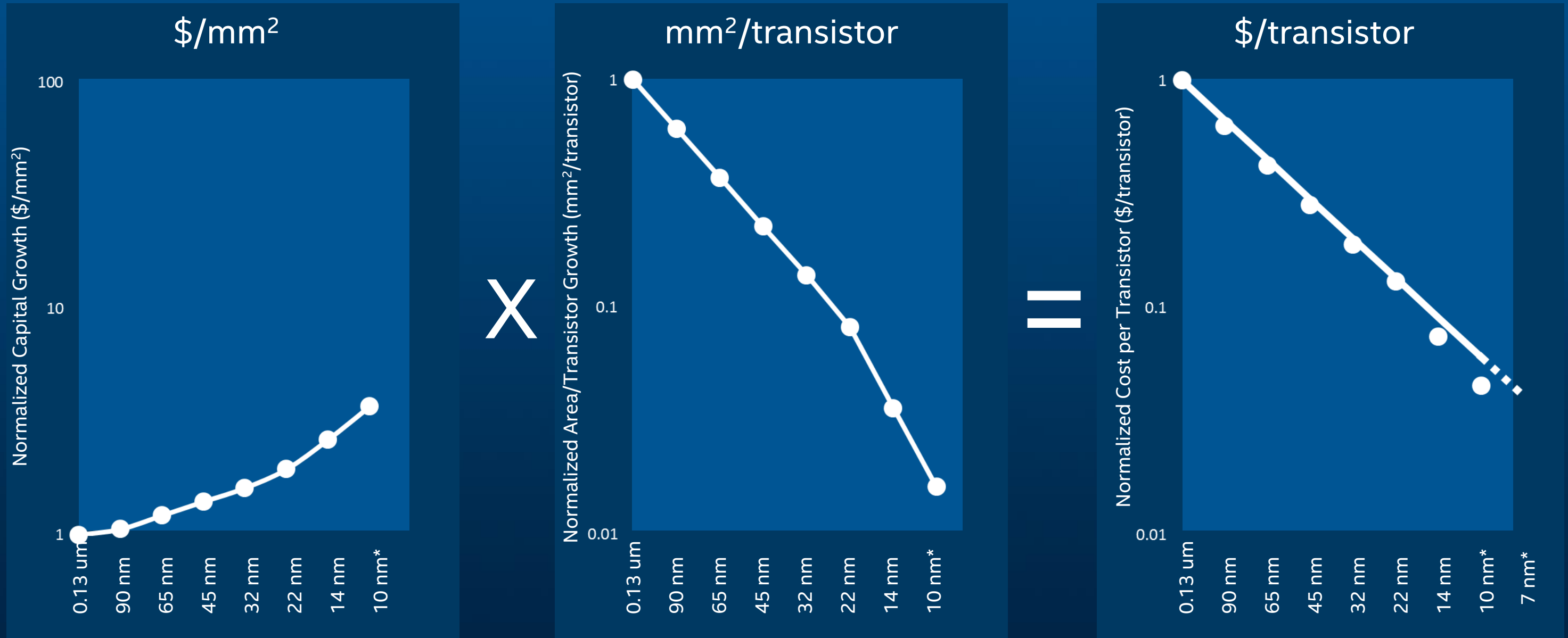


Exponential decrease in cost per transistor

But the cost of processed silicon is going up..

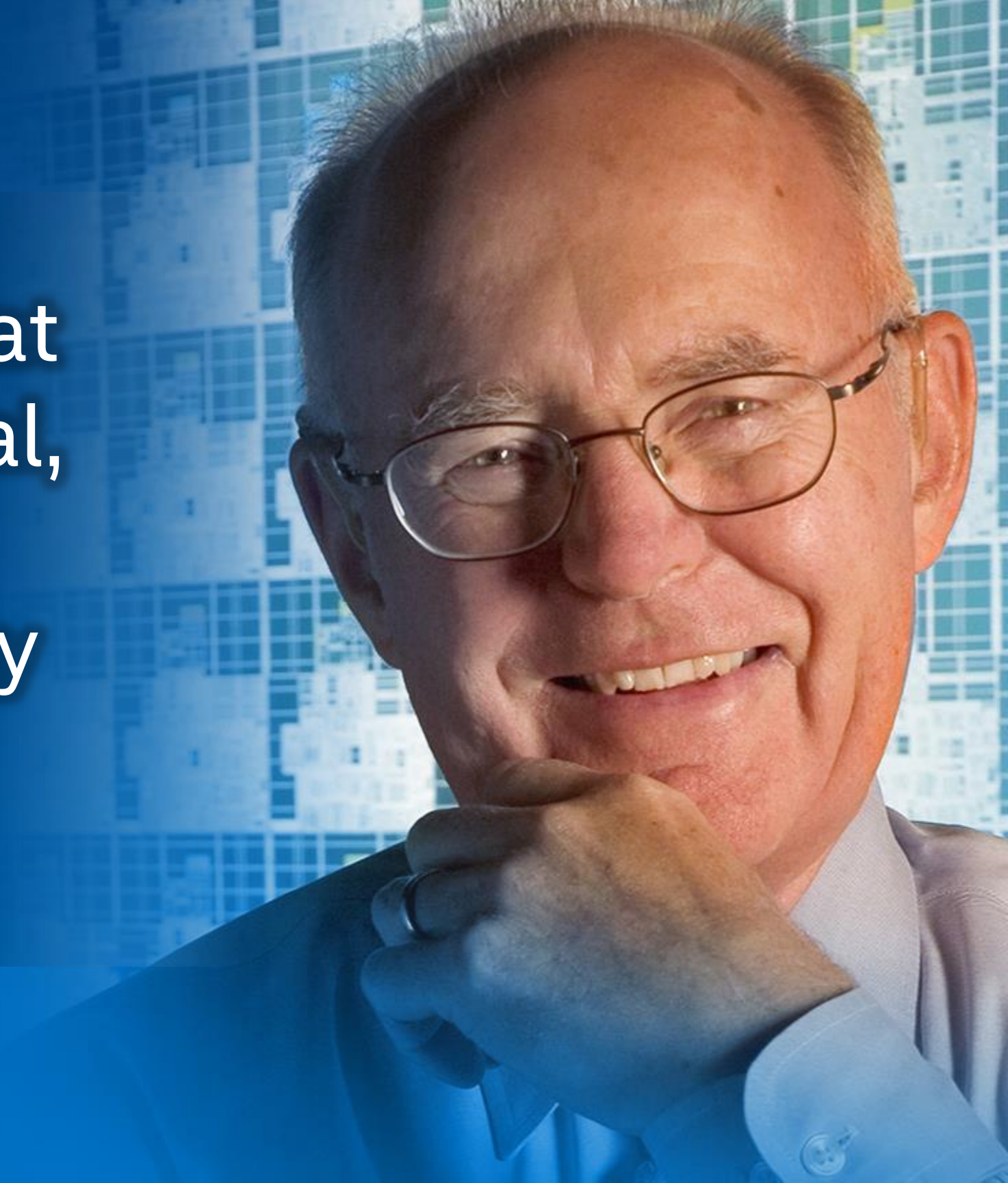


Moore's Law economics



‘The important thing is that
Moore's Law is exponential,
and no exponential is
forever... But we can delay
forever’

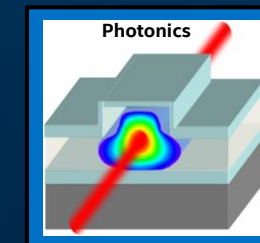
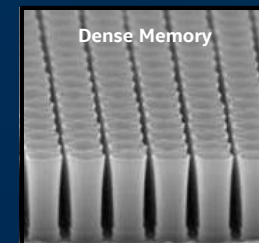
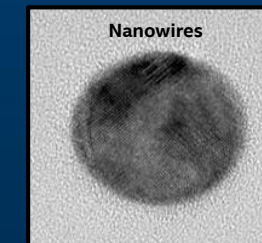
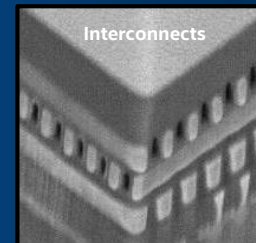
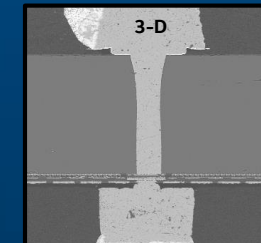
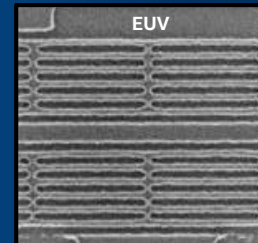
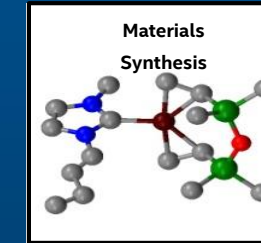
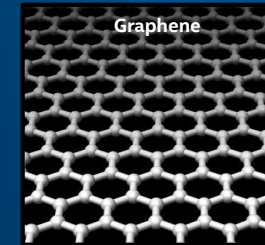
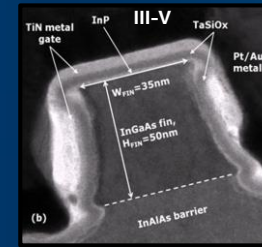
- *Gordon Moore, ISSCC 2003*



Delaying Forever

Future Technology Options

Expect
More
From
Moore

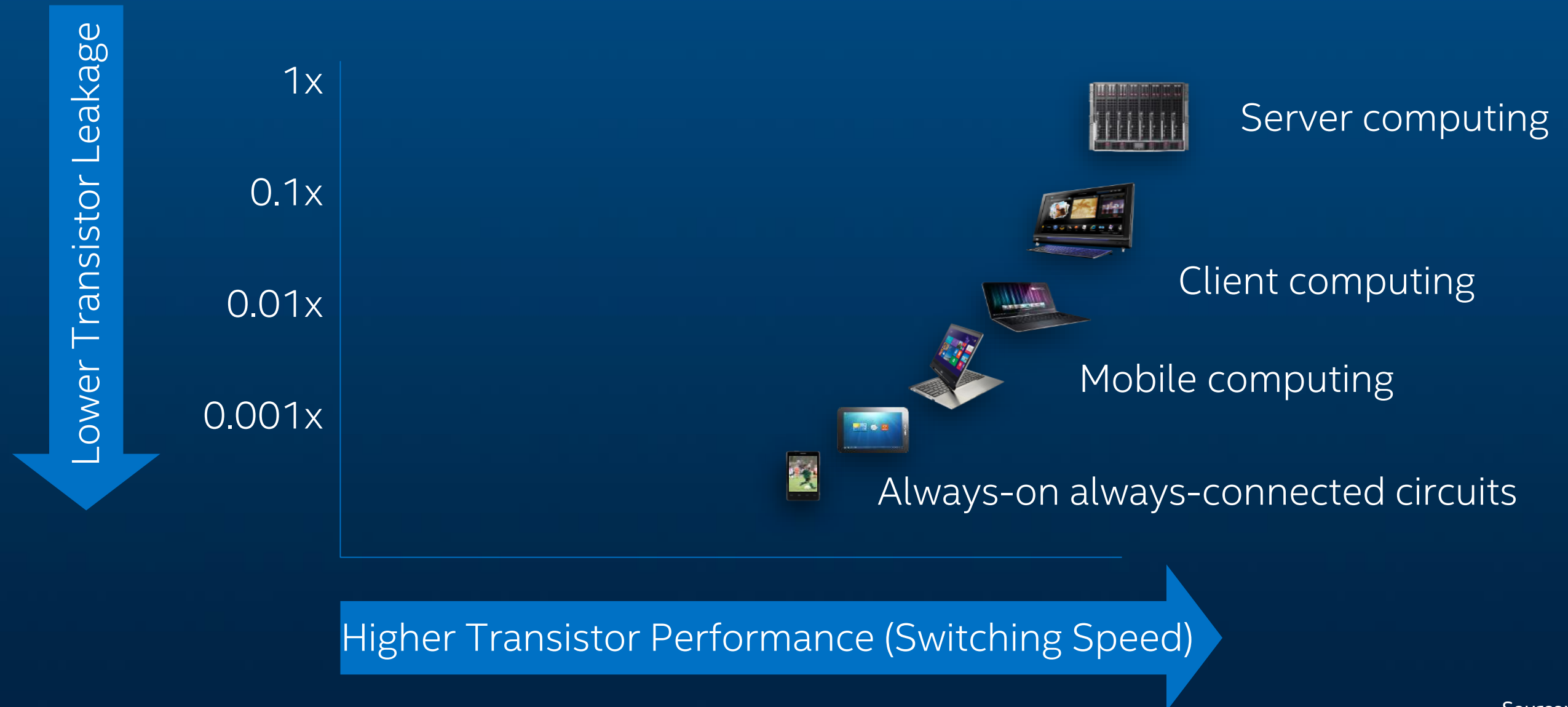


Future options subject to change

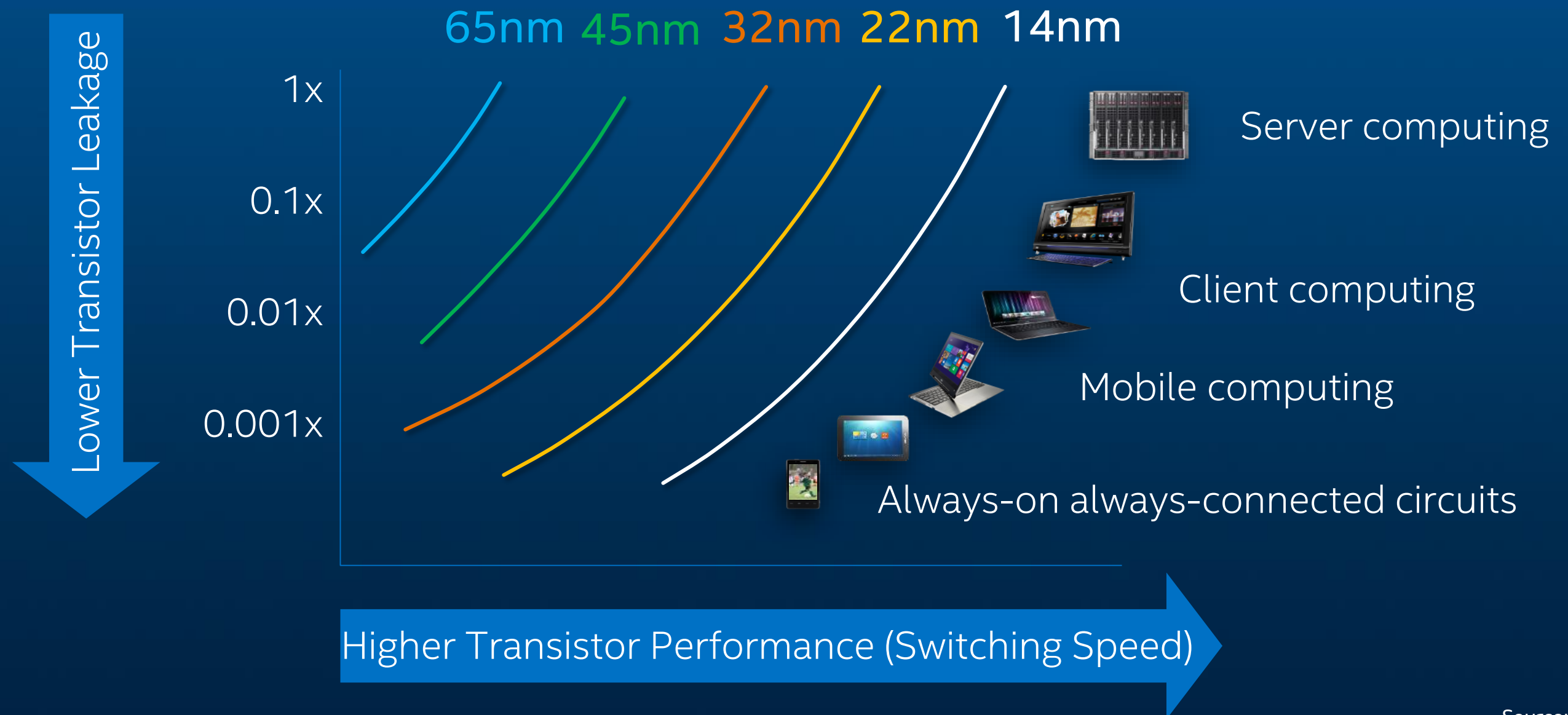


Silicon technology challenges and opportunities

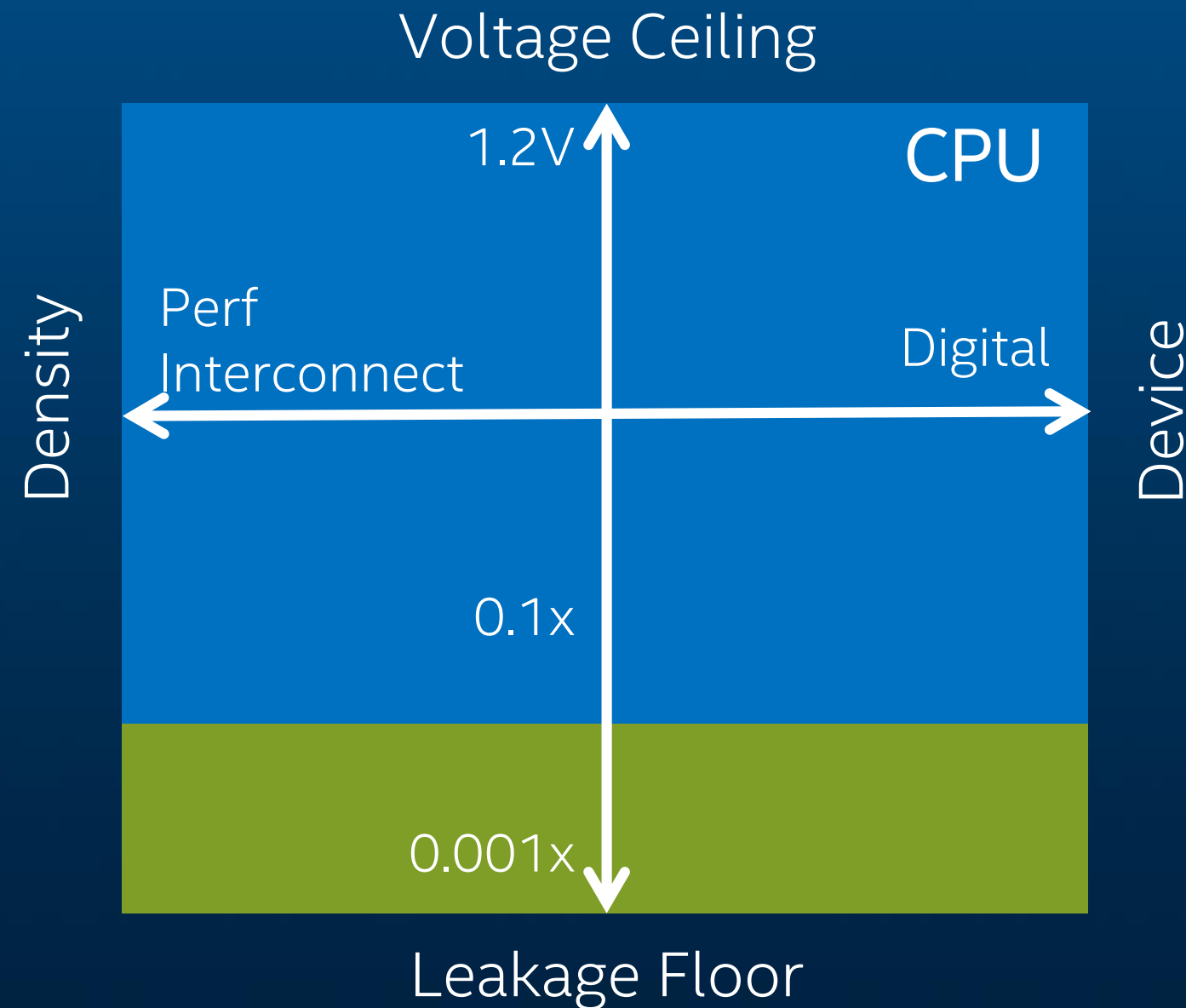
The challenge of integrating transistors that serve different power-performance needs



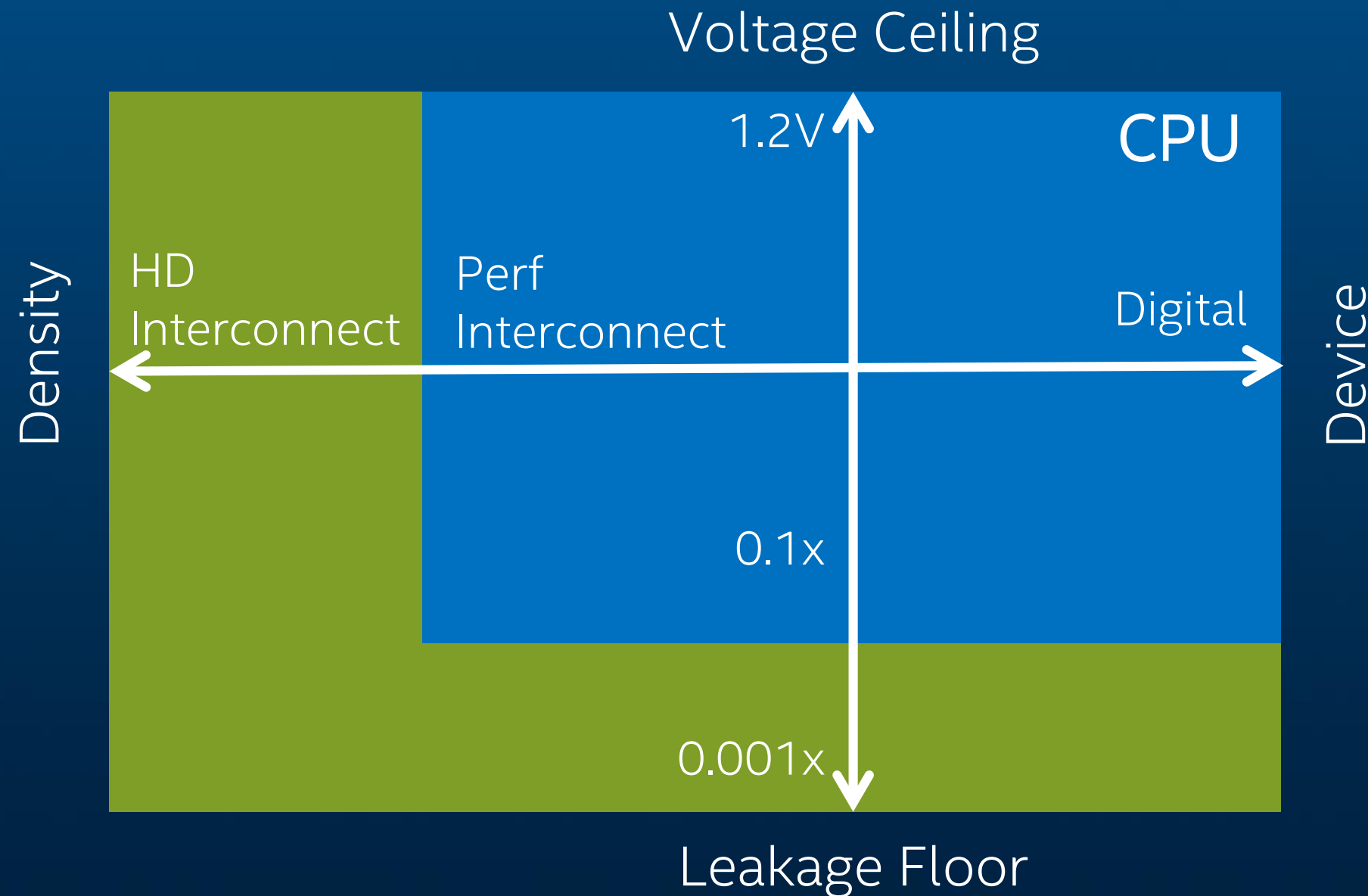
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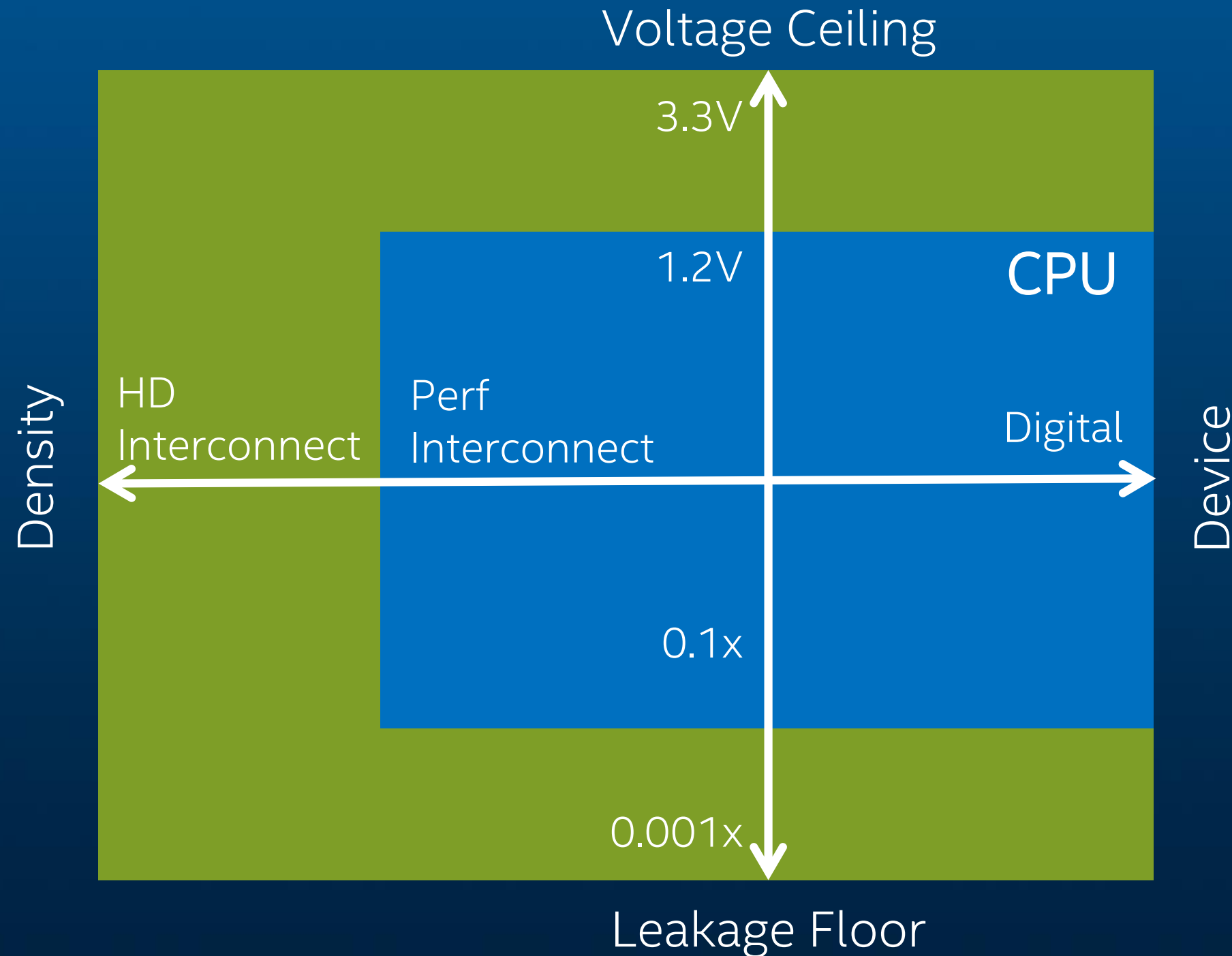
Integrating system functions on a chip requires multi-dimensional technology envelope expansion



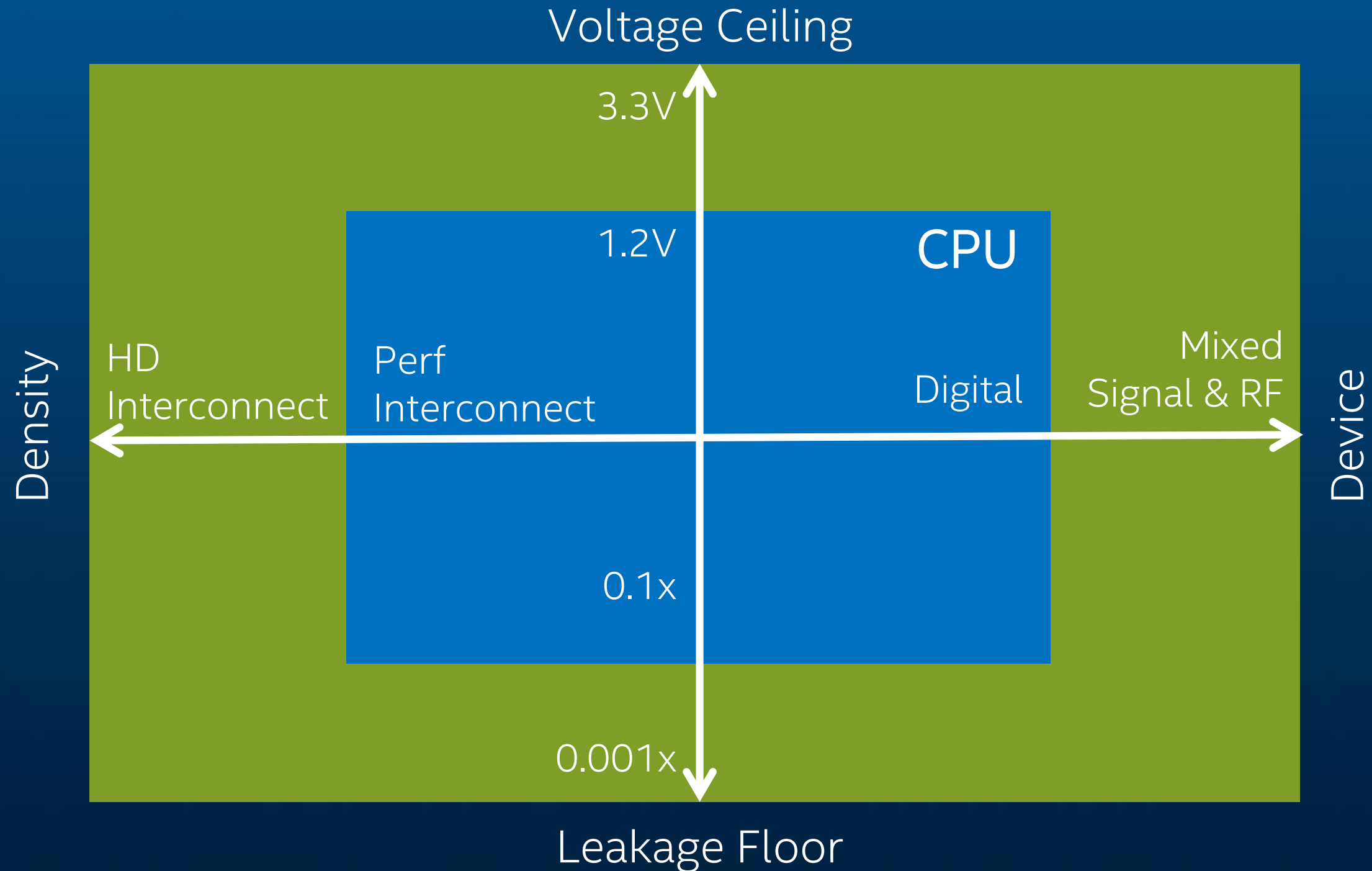
Integrating system functions on a chip requires multi-dimensional technology envelope expansion



Integrating system functions on a chip requires multi-dimensional technology envelope expansion



Integrating system functions on a chip requires multi-dimensional technology envelope expansion





Heterogeneous Integration

Packaging technology for multi-component integration

Today

Reduced Form Factor



Intel Atom
Package on Package

Performance Boost



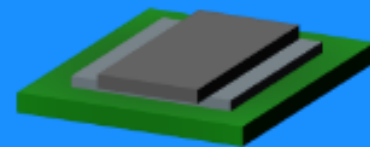
Intel Core w/Iris
Pro Graphics
CPU + eDRAM

Increased Functionality

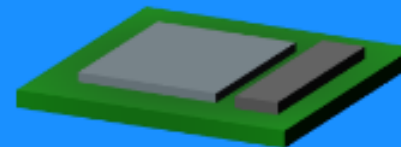


Intel Core i7
Logic Integration
CPU + PCH

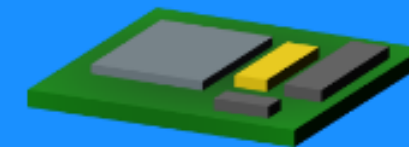
Tomorrow



3D Chip Stacking



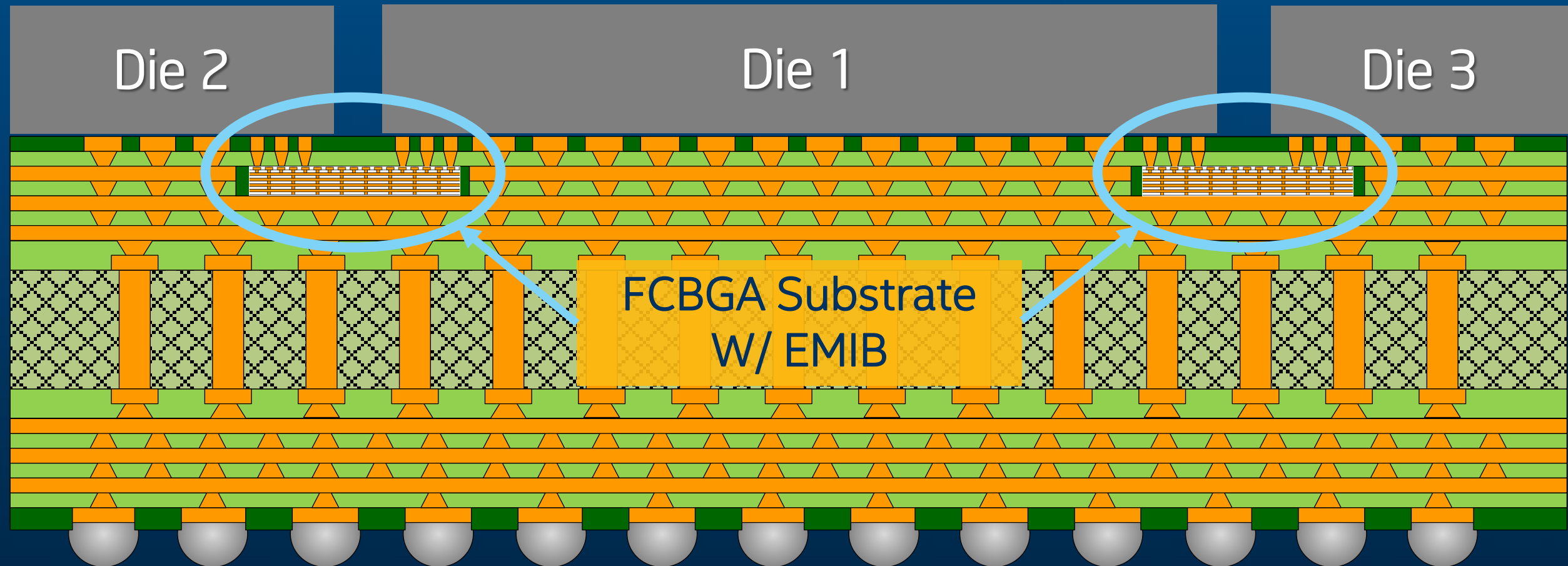
High Density
Interconnects



System in Package

Embedded Multi-die Interconnect Bridge (EMIB)

An elegant approach to in-package high density interconnect of heterogeneous die





Design challenges & opportunities in integration

System driven design

Development
Cost

Time to
Market

Usability

Reliability

Production
Cost

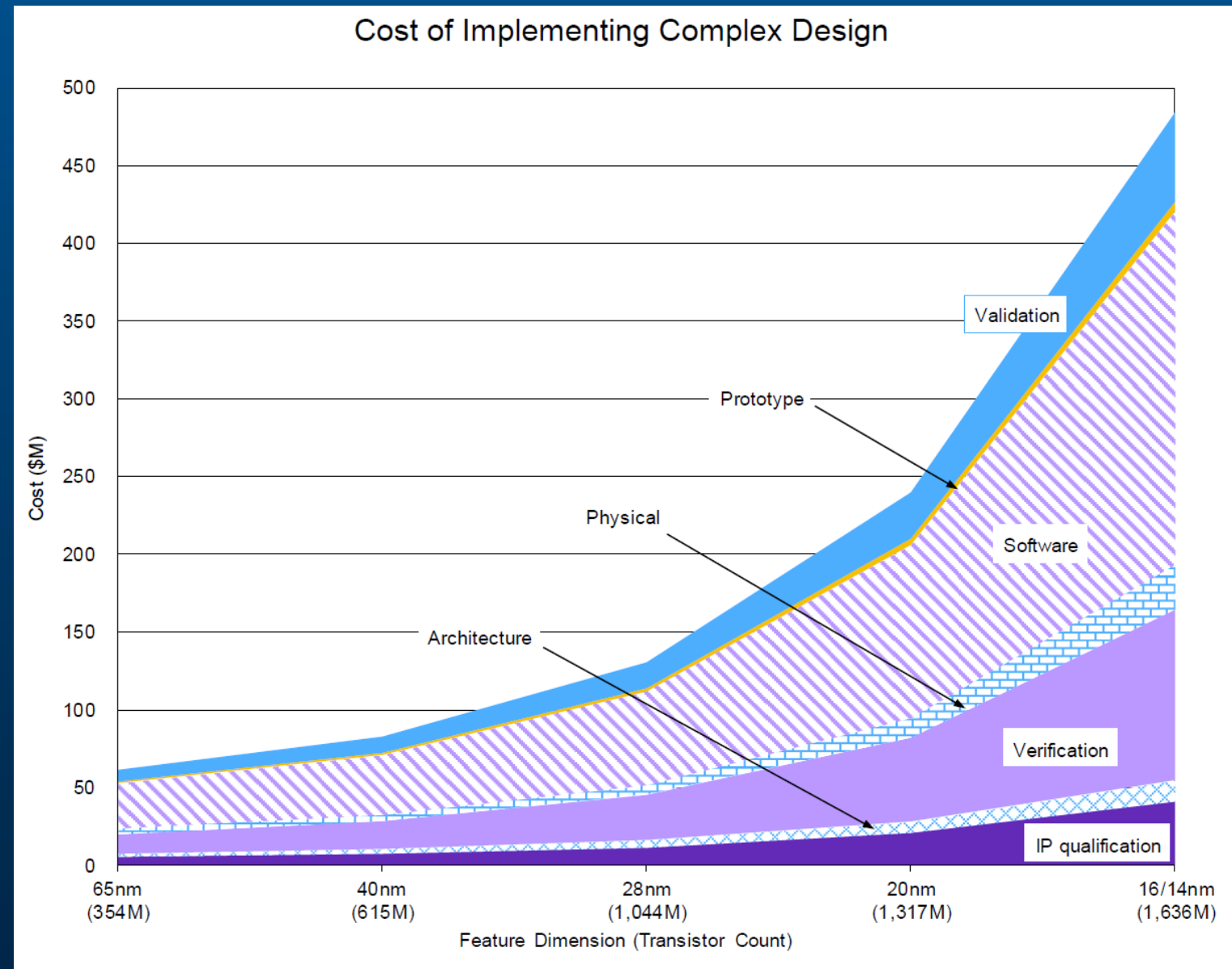
Security

Power

Performance

Trade-off decisions

Design complexity



Source: IBS, July 2013

Taming Complexity

Design for Reuse: Effort amortization & TTM

Taming Complexity

Design for Reuse: Effort amortization & TTM

Design for flexibility: Multi-party sourcing

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Design for yield: Logic redundancy & repair

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Taming Complexity

Design for Reuse: Effort amortization & TTM

Design for flexibility: Multi-party sourcing

Design for test: Proactive decisions

Design for yield: Logic redundancy & repair

Design for reliability: Thermals

Design for productivity: ASIC

India's role in the smart & connected world



Visionary policy

Investment

Local innovation &
Entrepreneurship

Summary

- The digital revolution is entering a new phase of growth with IOT
- Integration will continue to be the driving semiconductor trend enabled by Moore's Law
- Technologists and designers will work together, just as they always have, to overcome challenges and to make the most of opportunities.
- Pro-growth policy, investments, innovation and entrepreneurship will help India seize this moment of opportunity



Each of us has a role to play in
the ride to our future

My role is to deliver on the following promise..

If it computes and connects,
it does it best with Intel



Intel Custom Foundry



Leading at the Edge of Moore's Law



May you do well in delivering
on your own promise...



Thank you

Q & A



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Abstract

In this talk we will start with an assessment of where we are in building a smart and connected world and add to it some trends that suggest where we are headed. We will then discuss what it means to the semiconductor industry and what we must collectively do as silicon technologists and designers to enable our future and to thrive in our journey to it.